

“MastiMIR” - A mastitis early warning system based on MIR spectra

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At farm level the mastitis disease appearance decrease the milk production, produce veterinary costs and welfare issues, increase the culling rate or cause lower milk payment (Bastin *et al.*, 2013, Guimarães *et al.*, 2017). Because mastitis is associated with a wide range of characteristics that can be measured in milk and with recent advances in estimation of milk components using mid-infrared spectrometry (Soyeurt *et al.*, 2009), it is now possible to have the composition of several additional milk components such as fatty acids, lactoferrin (Leclercq *et al.*, 2013), minerals, negative energy balance, non-esterified fatty acids and beta-hydroxybutyrate or citrate (Grelet *et al.*, 2015), etc. The objective of this study was to build a spectrometric tool for Alsace, such as MastiMIR in LKV B.W. and to work out if it is possible to determinate by means of the milk quality the animal health status. Furthermore, the aim was to evaluate the usability of farmer observations and MIR indicators for the improvement of early mastitis prediction. The dataset contains 303,650 spectral data from 123 herds between 2014 and 2018. The first trial is composed from 70% of data in calibration and 30% in validation, while the second trial from 70% and 30% respectively of farms in calibration and validation datasets.

Abstract

To identify animal variables that were positively or negatively associated with mastitis, the spectral data was first standardised, then pre-processed by first derivative and the legendre polynom model was applied for days in milk correction. For the ill class, spectral data with mastitis diagnosis for a given cow within -14 to +14 days was chosen, while for the healthy class no diagnosis data was registered. As fix effects were considered the sampling moment, lactation stage, and breed. For this model no somatic cell filter was used. The MastiMIR calibration model showed 77.7% sensitivity and 68.4% specificity for the final calibration model. The external validation showed 67.1% sensitivity and 68.1% specificity. For the same period if the somatic cell SCC filter was done: 400,000 SCC filter for non-healthy data and 50,000 SCC filter for healthy data the sensitivity and specificity are increased to 85.5% and 72.7% respectively. The MastiMIR model provides four classes of mastitis warning such as not, moderately, significantly and severely endangered. The moderately endangered class is a signal for the farmers to keep an eye on the affected animals and contact a vet if applicable in order to prevent the mastitis diseases.

Keywords: mastitis, spectrometry, MIR milk spectral data, dairy cow, cow health